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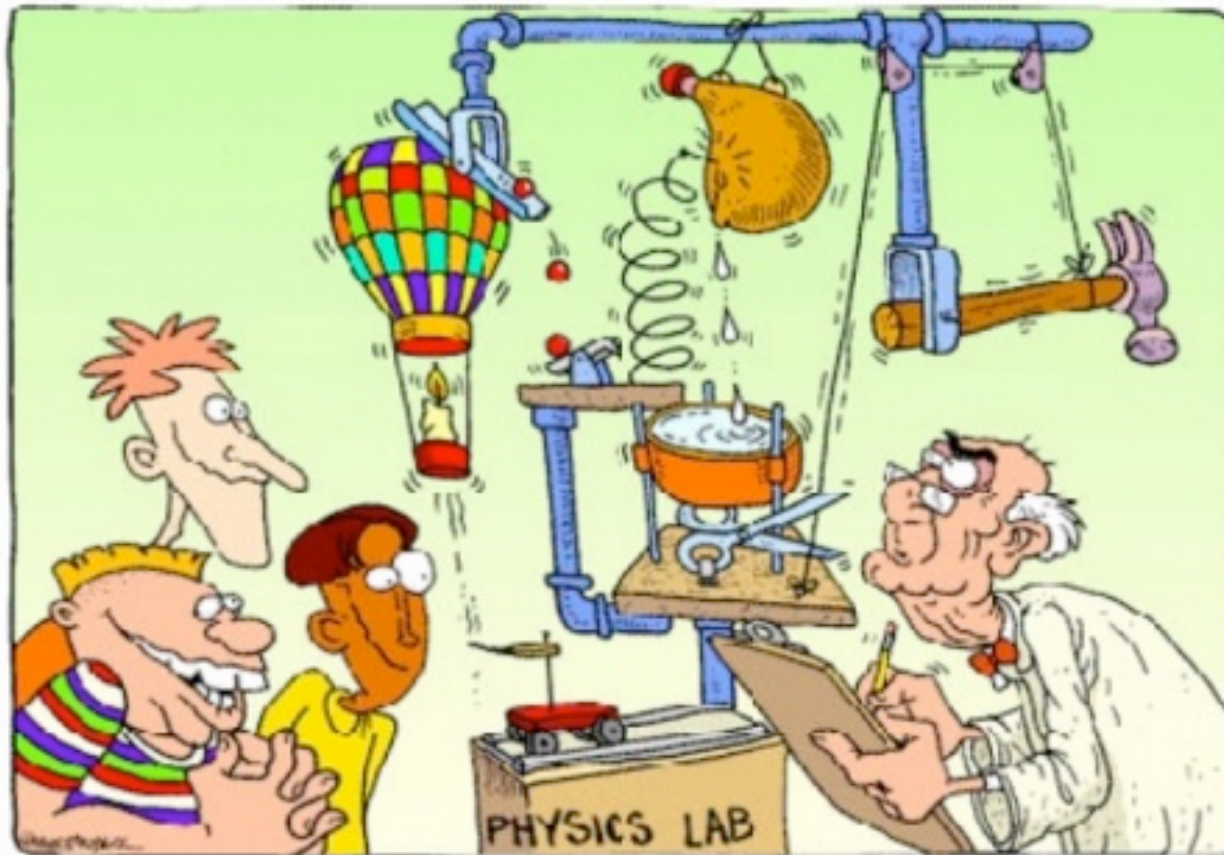
# *A few Microwave/RF Basics*

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*Welcome to the Microwave Measurements Class*



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# *What' a dB?*

## **dB (decibel)**

Means of expressing large ranges via a logarithmic ratio.

Can be the ratio of anything For RF it is power.

$$10 \cdot \log(A/B) = \text{dB}$$

In RF and Microwave systems, typical ratios of voltage and power are often expressed in dB

An amplifier or attenuator doesn't know or care if you are interested in volts or watts, a dB is a dB.

$$\text{Watts} = \text{Volts}^2 / \text{Resistance}$$

Or

$$P = V^2 / R$$

$$\text{Ratio of watts is } 10 \cdot \log(P1/P2) = \text{dB}$$

Ratio of volts is

$$10 \cdot \log(V1/V2)^2 = \text{dB}$$

$$20 \cdot \log(V1/V2) = \text{dB}$$

for normalization to one volt, or one watt, or one milliwatt  
set V2 or P2 to that value to get  
dBV, dBW, or dBm

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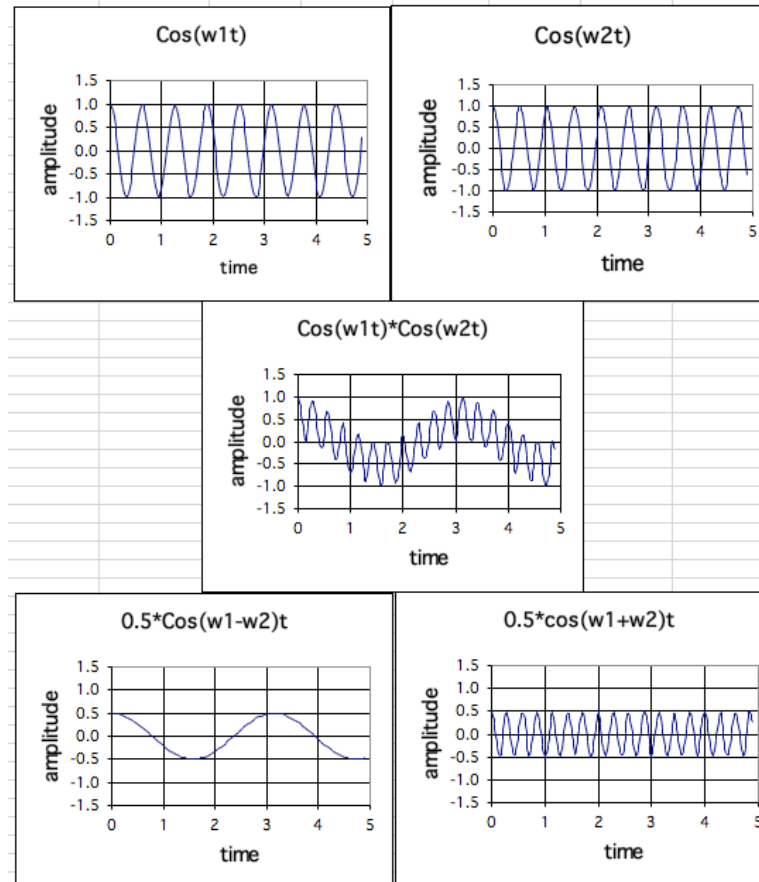


# *Fermilab Multiplying or Mixing*

RJP 1/03/02

## Multiplying or "Mixing" signals

$$\cos(w_1 t) \cdot \cos(w_2 t) = 0.5 [\cos(w_1 - w_2)t + \cos(w_1 + w_2)t]$$



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# *Connectors*

*Type N*



*APC 7*



*TNC*



*BNC*



*SMA*



*Lemo*



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*Use Caution!*

*Treat this equipment as tough you owned it.*



*Static Electricity  
Will ruin the instruments!*



*Don't over or under  
Tighten connections  
ALWAYS Turn the NUT!*

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